# Unit 3 Similarity Figures and Dilations

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**Target 1** – Use proportions to identify lengths of corresponding parts in similar figures

**Target 2** – Perform and identify dilations

**Target 3** – Use ratios of lengths, perimeter, & area to determine unknown corresponding parts

  - 3.3a – Use Scale Factor & Similarity to Determine Unknown Lengths in Polygons & Circles
  - 3.3b – Use Scale Factor & Similarity to Determine Unknown Corresponding Parts

**Target 4** – Perform compositions of figures to determine the coordinates and location of the image

Name: __________________________
3.1 – Similar Figures

Target 1 – Use proportions to identify lengths of corresponding parts in similar figures

**Vocabulary**

- **Similar Polygons:** change of ______________ or ________ of a figure

- **Linear Scale Factor:** ______ of the _________ of ______________ sides.

**Example 1: Use similarity statements**

In the diagram, \( \triangle ABC \sim \triangle DEF \).

1. List all pairs of congruent angles

   \[
   \begin{align*}
   \angle A & \sim \angle D \\
   \angle B & \sim \angle E \\
   \angle C & \sim \angle F
   \end{align*}
   \]

2. Check that the ratios of corresponding side lengths are equal.

   - **Ratio 1:** 
   - **Ratio 2:** 
   - **Ratio 3:** 

   Are all three ratios equal?

3. Write the ratios of the corresponding side lengths in a statement of proportionality.

**Example 2: Find the linear scale factor**

Determine whether the polygons are similar. If they are, write the similarity statement and find the scale factor of \( \triangle ABC \) to \( \triangle DEF \).

Step 1: Identify pairs of congruent angles (Write congruent statements for all pairs)

   \[
   \begin{align*}
   \angle A & \sim \angle D \\
   \angle B & \sim \angle E \\
   \angle C & \sim \angle F
   \end{align*}
   \]

Step 2: Show that corresponding side lengths are proportional.

   - **Ratio 1:** 
   - **Ratio 2:** 
   - **Ratio 3:** 
   - **Ratio 4:**

   Are all four ratios equal? If so, what is the linear scale factor?
YOU TRY NOW!

1) The two figures below are similar. What is the linear scale factor?

2) The triangles are similar: \( \triangle DEF \sim \triangle RQP \). Which angles are congruent?

3) \( \triangle ABC \sim \triangle DEF \). What is the length of \( FE \)? The triangles are similar.

4) \( \triangle ABC \sim \triangle DEF \). What is the length of \( ED \)?

5) **HONORS ONLY** \( \triangle STU \sim \triangle FED \). \( ST = x + 2 \), \( UT = x^2 - x - 14 \), \( DE = 2 \), and \( DE = 2 \). Find the measure of \( ST \).

6) **HONORS ONLY** The lengths of the sides of a triangle have a ratio 1:2:3. If the perimeter of the triangle is 60 yards, what is the length of the smallest side?
3.2 – Dilations
Target 2 – Perform and identify dilations

Vocabulary
Dilation: a transformation where the ________________ or ________________ of a figure occurs, where the sides are ___________ or ______________ proportionally about a center. Dilations do not change the ________________ of the ________________.

Example 1: Identify dilations
Determine whether the dilation is a reduction (shrink) or an enlargement (expand). Find the scale factor of the dilation.

a) 

b) 

Example 2: Perform a dilation
Dilate \( \overline{AB} \) by a scale factor of \( \frac{2}{3} \).

Example 3: Use scalar multiplication in a dilation
The vertices of triangle ABC are A (-3, 0), B (0, 6), C (3, 6). Use scalar multiplication to find A'B'C' after a dilation with center at the origin and a scale factor of \( \frac{1}{2} \). Graph ABC and its image.
1) **HONORS ONLY** Find the center of dilation of the two similar triangles below.

2) $\triangle ABC$ is dilated to form triangle $\triangle A'B'C'$. If $\frac{AB}{A'B'} = 7$, what is $\frac{B'C'}{BC}$?

3) The vertices of $\triangle ABC$ is $A(-7, 8)$, $B(7, -5)$, $C(8, 10)$. Find the vertices of the dilated image with scale factor of $\frac{1}{2}$. The center of the dilation is the origin.

4) **HONORS ONLY** The vertices of $\triangle ABC$ is $A(-3, 4)$, $B(3, -2)$, $C(2, 3)$. Find the vertices of the dilated image with scale factor of 2. The center of the dilation is $(0, 1)$.

---

**Annotate Here**

**Reflection**

What concepts were important to take away from this target?

1. 

2. 

3. 

**Questions**

1. 

2. 

3.
3.3a – Use Scale Factor & Similarity to Determine Unknown Lengths in Polygons & Circles

Target 3 – Use ratios of lengths, perimeter & area to determine unknown corresponding parts

**Example 1:** Use similar polygons to find lengths of unknown corresponding parts

The two rectangular swimming pools are similar. How far is it diagonally across each pool?

![Diagrams of two similar swimming pools]

- 15 meters
- 12 meters
- 20 meters
- 16 meters

**Example 2:** Use similar polygons to find lengths of unknown corresponding parts

A high school wants to build a basketball court that is similar to an NBA basketball court, which is 94 feet long and 50 feet wide. Unfortunately, the high school has room for a court that is 42 feet wide. How long should the court be, to the nearest foot?

![Diagram of basketball court]

The scale factor is

\[
\frac{7}{5} \quad \text{or} \quad \frac{5}{7}
\]

depending on which circle is the pre-image

**QUESTIONS OR REFLECTION**

Write down at least 2 questions from this page to ask the next day.

1) 

2)
YOU TRY NOW!

1) Given the similar trapezoids ABCD and EHGF below, identify the side that is proportional to \(\overline{BC}\).

![Diagram of trapezoids ABCD and EHGF]

2) The vertex of B of octagon ABCDEFGH is located at (24, -16). The octagon is dilated by a factor of 0.25, with the center of dilation at the origin. What are the coordinates of B’?

3) Parallelograms ABCD and EFGH are similar. What is the length of \(\overline{GH}\)?

![Diagram of parallelogram ABCD and EFGH]
PERIMETERS OF SIMILAR POLYGONS

If two polygons are similar, then the ratio of their perimeters is equal to the ratios of their corresponding side lengths.

If KLMN ~ PQRS, then

\[
\frac{KL + LM + MN + NK}{PQ + QR + RS + SP} =
\]

Example 1: Find the perimeter of similar figures

A larger cement court is being poured for a basketball hoop in place of a smaller one. The court will be 20 feet wide and 25 feet long. The old court was similar in shape, but only 16 feet wide.

Find the scale factor of the new court to the old court.

Find the ratio of the perimeters of the new court to the old court.

Areas of Similar Polygons

If two polygons are similar with the lengths of corresponding sides in the ratio \(a:b\), then the ratio of their areas is \(\frac{a^2}{b^2}\).

Scale Factor:

\[
\frac{\text{Side Length of Polygon 1}}{\text{Side Length of Polygon 2}} = \frac{a}{b}
\]

Ratio of Perimeters:

Ratio of the Areas:
Example 2: Find the area of similar figures
What is the area of triangle XYZ? \( \triangle FMN \sim \triangle XYZ \).

\[
\text{A} = 72 \text{ ft}^2
\]

12 ft

YOU TRY NOW!

1) \( \triangle ABC \sim \triangle DEF \). \( AB = 3 \) inches, \( DE = 6 \) inches, and the area of \( \triangle ABC \) is 72 square inches. What is the area of \( \triangle DEF \)?

2) \( \triangle ABC \sim \triangle DEF \). Both triangles are also isosceles triangles. \( AB = 5 \) inches, \( EF = 21 \) inches, and the altitude (height) of \( \triangle ABC = 4 \). The altitudes bisects (divides \( EF \) into two congruent parts) the bottom sides of the triangles. Calculate the altitude of \( \triangle DEF \).
### 3.4 – Similarity and Transformations

**Target 4 – Perform compositions of figures to determine the coordinates and location of the image**

**Example 1: Perform the composition**

The vertices of a triangle ABC is shown below. The triangle is translated 5 units to the right creating image A'B'C'. Then, the image is reflected across the x-axis. Finally, the triangle is dilated by a factor of 1.5. What are the final coordinates of triangle A'''B'''C'''?

![Diagram of triangle ABC and its transformations](image)

#### Coordinates after each transformation

<table>
<thead>
<tr>
<th>Original (A, B, C)</th>
<th>A'B'C'</th>
<th>A''B''C''</th>
<th>A'''B'''C'''</th>
</tr>
</thead>
<tbody>
<tr>
<td>A( , )</td>
<td>A'( , )</td>
<td>A''( , )</td>
<td>A'''( , )</td>
</tr>
<tr>
<td>B( , )</td>
<td>B'( , )</td>
<td>B''( , )</td>
<td>B'''( , )</td>
</tr>
<tr>
<td>C( , )</td>
<td>C'( , )</td>
<td>C''( , )</td>
<td>C'''( , )</td>
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Rotate K 270 degrees CCW direction

Graph y = 2

Graph x = -1

Annotate Here
**YOU TRY NOW!**

1. Describe the composition of transformations. Give the exact translation, reflection or rotation using proper notation.

   Transformation 1:

   Transformation 2:

2. **HONORS ONLY** The endpoints of $\overline{CD}$ are $C (-2, 3)$ and $D (0, -2)$. Graph the image of $\overline{CD}$ after the composition.

   Transformation 1: Dilate by a scale factor of 3 centered at $(-1, 0)$
   Transformation 2: Rotation: $90^\circ$ clockwise about $(-1, 1)$

**SUMMARY**

In your own words, describe what a composition is.